
Properties of common hawthorn (*Crataegus monogyna* Jacq.) populations

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Three natural stands of common hawthorn (*Crataegus monogyna* Jacq.) 1–5 ha in size were located representing populations of northern, middle and southern Lithuania. Ecogeographical conditions of the stands (soil properties, slope aspect, co-ordinates) were determined as well as their biological properties (coverage, species composition, height, fruiting, total viability) and fruit active constituents were studied. The poorest soil conditions and pest (*Tetranychus viennensis* Zach.) infestation resulted in the lowest contents of fruit flavonoids and total extractive substances in the northern population of *Crataegus monogyna* Jacq.

Key words: common hawthorn, *Crataegus monogyna* Jacq., flavonoids, extractive substances, active constituents, population, stand

INTRODUCTION

There are at least several important species of medicinal plants in the temperate climatic zone in Europe, which are under-utilised or neglected. In Lithuania the species of hawthorn (*Crataegus* L., *Rosaceae*) might be regarded as one of them [1]. The needs of Lithuanian pharmaceutical industry in hawthorn raw material are satisfied with the local material incompletely. Some economic reasons, biological peculiarities as well as a scattered distribution pattern of the species cause the under-utilisation of Lithuanian hawthorn resources. Lack of knowledge on their intraspecific diversity as well as localisation regularities of active constituents in the plants are among the reasons of underestimation of the resources available.

The purpose of this work was to locate the natural stands of wild hawthorn populations and to conduct comparative studies on their ecological conditions and biological properties with the stress on the contents of biologically active constituents.

MATERIAL AND METHODS

In 1999–2000, several field trips were made across Lithuania in order to locate pure stands of wild hawthorn species. As a result, three geographically distant stands of common hawthorn (*Crataegus monogyna* Jacq.) populations were selected on the North–South line (Table 1). Vegetation of the stands was described as well as herbarium specimens were taken. Four randomly chosen soil samples were taken in each stand for the analysis of nutrient contents (N, P, and K), humus, and pH. The stands were visually evaluated for fruiting intensity (on a 1–9 scale) and total viability. Fruit samples of 1–3 individuals (biotypes) were collected in each stand for chemical analysis after their full maturity in September 2000. Fruit analysis for flavonoid, extractive substances, and moisture contents was carried out according to the State Pharmacopoeia of the USSR [2], except that for the standard flavonoid rutin was used instead of hyperozide.

Table 1. Size and location of selected stands of *Crataegus monogyna* Jacq

No.	Stand/population	Stand area, ha	District	Protected area	Central co-ordinates
1	Venta	5.0	Akmenė	Venta Regional Park	N 56°06'19" E 22°50'48"
2	Šušvė	1.0	Kėdainiai	Pašūšvys Landscape Reserve	N 55°24'45" E 23°38'19"
3	Dusia	1.0	Lazdijai	Meteliai Regional Park	N 54°17'12" E 23°40'11"

RESULTS AND DISCUSSION

As was observed during the field trips, common hawthorn grows at riversides, margins of lakes, field edges, and roadsides. Young individuals also occur in forests, but at later stages of succession, when shading by trees assumes greater significance, they become weak, cease flowering, and eventually die [3]. Natural pure stands of hawthorn species are rather rare in Lithuania, except for its southern part. In southern Lithuania hawthorn species are frequent components of the *Rhamno-prunetea* Rivas Goday et Borja Carbonell 1961 communities [4].

The biggest stand of common hawthorn (*ca.* 5 ha) was registered at the left side of the Venta River in the Venta Regional Park, northern Lithuania (No. 1, Table 1). The stand stretches along the river over 1 km covering about 40% of the slope with an eastern aspect mainly. The distribution of the plants within the stand is rather scattered if compared to the forest tree stands. Crowns of shrubs do not reach each other in most cases. Average height amounts to 3–4 m. Individuals of *Crataegus monogyna* Jacq. make up to 60% of all woody plants in the stand. The rest is for *Frangula alnus* Miller, *Rhamnus cathartica* L., *Sorbus aucuparia* L., *Malus sylvestris* (L.) Mill., *Pyrus communis* L., *Salix cinerea* L., *Corylus avellana* L., *Juniperus communis* L., and young *Pinus sylvestris* L. An utmost fruiting (9 points) of *Crataegus monogyna* Jacq. was observed in 2000. However, an outbreak of *Tetranychus viennensis* Zach. depleted the growth of plants, damaging over 80% of hawthorn leaves and a significant part of fruit. *Crataegus monogyna* Jacq. looked like leafless individuals but all in red fruit decoration.

The stand of the Šušvė population (No. 2, Table 1) is located at the right side of the Šušvė River on the slope with SW aspect, the Šušvė Landscape Reserve, middle Lithuania. It is smaller in size (*ca.*

1 ha), but much more compact and concentrated. Individuals of *Crataegus monogyna* Jacq. amount to over 80% of all woody plants in the stand, covering about 80% of the land surface. Crowns of hawthorns overlap each other in many cases. The average height amounts to 3–4 m. Fruit yielding was estimated to 8 points. The woody cover contains *Malus sylvestris* (L.) Mill., *Pyrus communis* L., *Padus racemosa* L., *Rhamnus cathartica* L., *Populus tremula* L., and *Eunymus europeus* L.

The stand of the Dusia population (No. 3, Table 1) wraps up an oblong (from N to S) hill at the western margin of Lake Dusia, the Meteliai Regional Park, southern Lithuania. This is a compact stand with an average cover of 80%. Crowns of common hawthorn plants overlap each other in many cases. Many individuals have acquired a habit of trees and reached a height of 8–9 metres. The average height is lower (5–6 m), because the age structure of the plants varies within a widest range – from 1-year-old juveniles to mature trees about 40–50 years old. Fruiting was estimated to 7 points. The woody cover contains *Malus sylvestris* (L.) Mill., *Pyrus communis* L., *Rhamnus cathartica* L., *Pinus sylvestris* L., *Rosa glauca* Vill., and *Sorbus aucuparia* L. As hawthorn spreads very extensively there, it could be considered that the stand occurs within the area of an ecological optimum of the species. Some preventive measures, *e.g.*, burning, are even taken by the local people to stop the spread of hawthorn.

Fruit chemical analysis (Table 2) revealed that the biotype D-1 of the Dusia population in southern Lithuania contained the highest amounts of flavonoids (0.301%) and total extractive substances (57.4%). The biotypes of the Šušvė population also indicated high contents of flavonoids (0.219 and 0.300%). The lowest contents of flavonoids and extractive substances were observed in the Venta population, probably because of the invasion of *Tetrany-*

Table 2. Data of fruit chemical analysis of *Crataegus monogyna* Jacq

Sample ID	Biotype	Population	Flavonoids, %	Extractive substances, %	Moisture, %
JL-1	V-1	Venta	0.135	27.2	10.6
JL-2	S-1	Šušvė	0.300	37.1	10.5
JL-3	S-2	Šušvė	0.219	37.2	10.2
JL-5	D-1	Dusia	0.301	57.4	12.5
JL-6	D-2	Dusia	0.134	51.2	11.7
JL-7	D-3	Dusia	0.114	42.7	12.2

Table 3. Soil properties of the selected stands of *Crataegus monogyna* Jacq. populations

Stand/population	Total N, %	Available P ₂ O ₅ , mg/kg	Available K ₂ O, mg/kg	Humus, %	pH _{KCl}
Venta	0.069	97.8	142.3	1.87	7.54
Šušvė	0.149	259.8	172.9	3.08	7.56
Dusia	0.241	198.6	138.4	3.39	7.55

chus viennensis Zach., which heavily damaged the stand. According to the data of chemical analysis, the soil of the Venta population was poorest in total N – 0.069%, available P₂O₅ – 97.8 mg/kg, available K₂O – 142.3%, and humus – 1.87% (Table 3). No evident relationship was observed between the soil properties and the contents of fruit active constituents in other populations.

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VIENAPIESTĖS GUDOBELĖS (*CRATAEGUS MONOGYNA* JACQ.) POPULIACIJŲ SAVYBĖS

S a n t r a u k a

1999–2000 metais Šiaurės, Vidurio ir Pietų Lietuvoje buvo atrinkti trys gryni vienapiestės gudobelės medynai, atstovaujantys atitinkamai Ventos, Šušvės ir Dusios populiacijoms. Nustatytos šių medynų ekologinės sąlygos (dirvožemio cheminės savybės, reljefo konfigūracija), geografinės koordinatės, įvertinti biologiniai rodikliai (rūšinė sudėtis, projekcinis padengimas, aukštis, derėjimo intensyvumas, bendras gyvybingumas) ir veikliųjų medžiagų kiekis vaisiuose. Blogiausios augimo sąlygos Ventos populiacijos medyne (nederlingiausias dirvožemis) bei masinė gudobelinės erkutės (*Tetranychus viennensis* Zach.) invazija lėmė mažesni veikliųjų medžiagų kiekį vaisiuose, lyginant su kitomis populiacijomis.